

The user manual

Hand-held laser welding system



P/N: 110701001

Model: A1500W

Ver: V1.1

Date: 20210730

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Before using this product, please read the user's manual carefully and be familiar with the relevant content we have compiled for you. Please place the user guide together with the product to provide you and all other users with operational, security, and other important information at all times.

Note

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This guide is intended for users who are responsible for welding in industrial and non-industrial installations.

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Safety information

Convention for the safety

We will use different words and characters to remind you of various potential hazards and important information, including:

WARNING



This signal indicates that you need to use the signal according to the specified method or procedure. If you do not follow the warning correctly, you may cause personal injury to yourself or others. Do not go beyond the WARNING symbol if you do not fully understand and meet the required conditions.

CAUTION



Suitable for potential product damage. The signal reminds you to use the product according to the specified method or procedure. If you do not follow the instructions correctly, the product or parts may be damaged. If you do not fully understand and meet the required conditions, do not go beyond the CAUTION symbol.

IMPORTANT



Information about the use of this product. Please do not ignore this information.

WARNING



This symbol represents laser radiation. This symbol appears on products with laser output.

Safety instruction

To ensure safe operation and optimize the performance of this product, please strictly follow the following WARNING and CAUTION, as well as other information contained in this manual.

WARNING:

When using this product, ensure that the proper grounding power supply is used.

WARNING:

Users are not allowed to open any parts inside the product for maintenance. If necessary, please contact guanghui laser technical personnel to provide maintenance services. Any unauthorized changes to this product will invalidate the warranty.

WARNING:

The output connector of this product is connected by optical fiber cable and hand-held welding connector. Be careful when using hand-held welds.

WARNING:

If the product is not operated according to the instruction manual. The protection mechanisms provided by this product may be affected. This product must be used under normal conditions only.

CAUTION:

Always keep AC power off when operating laser welding output connectors (for example, installing optical cable connectors, using optical instruments to test end faces, wire filling, etc.).

WARNING:

Never look directly into an optical fiber output connector, and be sure to wear a proper protective eye mask when using laser products to avoid injury.

CAUTION:

Operations or adjustments outside the scope of this manual may result in radiation damage.

Laser grade

According to 21 CFR 1040.10 and 1040.11 under IEC/EN 60825-1, this product is a high power four-level laser. This product can output up to 2000W of non-visible infrared light. This level of laser can cause eye or skin damage. Even if the output light is invisible, it can still cause irreversible corneal damage. This product does not provide laser safety blindfold, but be sure to wear a proper blindfold when using the laser to avoid injury.



WARNING:

Never look into the optical fiber output connector, and be sure to wear a proper protective eye mask when using the laser to avoid injury.

WARNING:

The hand-held air-cooled laser welding system is a fourth-stage laser product that emits an invisible laser of up to 1500W with radiation wavelengths between 900nm and 1100nm.

WARNING:

Do not open the laser, because the laser does not have any product parts or accessories for the user to use. All product maintenance and repair can only be authorized by guanghui laser service personnel.

CAUTION:

Operations or adjustments outside the scope of this manual may result in radiation damage.

Use environment and matters needing attention

WARNING:

Use proper grounding power and normal voltage when using this product.

CAUTION:

Before starting the laser, make sure that the ambient temperature and humidity are within the specified range.

CAUTION:

Do not expose the product to excessive moisture.

CAUTION:

The laser is cooled by air. Please ensure that the ambient air is dry and clean;

CAUTION:

Operation or regulation beyond the scope of this manual may result in dangerous radiation damage.

CAUTION:

Keep the output welding joint clean. Close the protective cap after each use. Do not touch the welding lens by hand and do not use any solvent to clean the lens. When necessary to clean and maintain the lens, please be sure to use the mirror paper.

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1. An overview of the

1.1, introduced

Air series hand-held fiber laser welding system is a new type of industrial hand-held infrared fiber laser welding system. Its maximum continuous wave power rate is $\geq 1500\text{W}$ continuous, and the average power in pulse mode is $\leq 1500\text{W}$.

The Blade series fiber lasers built into the GW Handheld laser welding system are designed for industrial materials processing applications with the most reliable and efficient proprietary ABR and SPP technologies. Key innovations of the BLADE series of fiber lasers include proprietary thermal processing, mode filtering technology, and a durable and novel fiber laser structure. The BLADE fiber laser includes a powerful optical engine for full control as well as monitoring electronics. The beam is transmitted through a metal-protected QBH fiber cable.

The Blade series lasers provide a continuous wave (CW) single-mode output of up to 1500W in the output band between 1070nm and 1080nm. BLADE lasers provide very efficient, high quality output light. The best beam quality M2 output from single-mode cable is less than 1.2, or BPP < 1.5 high brightness multi-mode cable output. This high beam quality and multi-mode cable output option makes this product ideal for handling a variety of materials, such as fine cutting, precision welding, cutting and welding of different materials with different thickness.

GW hand-held laser welding systems are designed and tested with safety in mind. By following this user guide and applying laser safety measures, it can be a safe and reliable device.

To ensure safe operation and optimal performance of the product, follow the use warnings and other information contained elsewhere in this document. These safety precautions must be observed at all stages of operation, maintenance and repair of the instrument.

1.2, use

The Air series hand-held laser welding system is designed for industrial and professional use. Applications include welding and brazing. Materials include steel, aluminum, copper, stainless steel and other metal materials.

1.3. Test and certification

GW demonstrated that this system has been thoroughly tested and checked. Before packing, it is fully tested and confirmed to meet the shipping standards. When you receive the equipment, please check the packaging and parts for possible damage during transportation. If the damage is obvious, contact the carrier and GW's after-sales personnel immediately;

1.4 Packing and disassembly instructions

If there are any signs of external damage to the package, please check the equipment for damage and immediately notify the carrier and GW after-sales personnel; When you take the system out of the packing case, you must take special care to ensure that the optical fiber cable is not broken or damaged. Please check the packing list attached. Once the product is received, check all items with this list and under no circumstances attempt to install or operate laser equipment if any items are missing or if equipment is visibly or suspiciously damaged.

To reduce the risk of product damage, GW recommends that you use the following procedures to turn on a hand-held air-cooled laser welding system

1.4.1 Use a forklift with power source to move the whole packing case to the unpacking position;

1.4.2 Remove the top honeycomb board cover and the top EVA (white foam); Note: The welded joint is inside EVA;

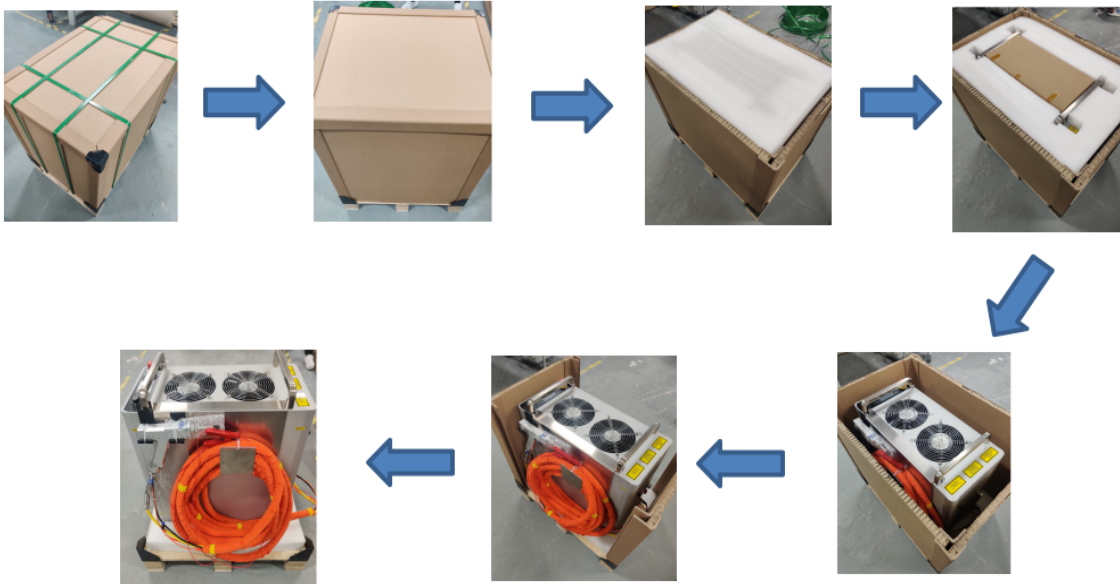
1.4.3 Cables and outer boxes are secured with fiber cable ties. Welding joints will also be wrapped. GW recommends using cutting tools to disassemble;

1.4.4 Place the removed welding joint on the top of the device. Do not pull or bend the cable. Do not attempt to use the attached cable ties or cables to lift the device;

1.4.5 Remove the side panels from the packing case. Remove the product from the packing case and use the two handles on top of the product. GW advises two people to lift the equipment at all times and be careful when handling cable ties and welding joints;

1.4.6 Check the attached details according to the items listed on the packing list;

1.4.7 Retain all packaging for future transportation or storage



Do not use the product accessories optical cable lifting or positioning equipment.

2. Laser product safety information

2.1 Safety performance of laser products and convention

To ensure safe operation and best performance of the product, please follow all warnings in this guide. Safety precautions must be followed at all stages of operation, maintenance, and service. Operators must follow these recommendations and apply declared laser safety practices at all times and never open modules. There are no parts, equipment or components that can be repaired by users. All internal services and maintenance should be performed only by qualified GW after-sales personnel;

This user guide uses a variety of words and symbols designed to alert you to potentially dangerous or important information.

2.1.1 Security Performance

performance	Describe
Output power monitoring	Monitors the output power of the laser while it is operating.
Overheating protection	Monitor the internal temperature of the laser to protect the internal components from damage due to exceeding the safe operating temperature.
Security/warning labels	Labels alert to warn users some possible and potential hazards.

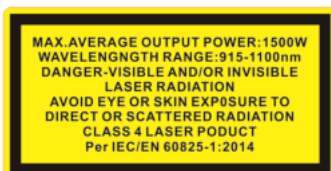
2.1.2 Security Labels

Safety label and label location:

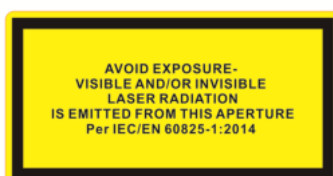
The following drawings show the label and its position on the product.



Laser outlet label
position: rear panel/welding joint



Certification label
location: rear panel



Warning label
location: rear panel/weld joint



Certification label
location: rear panel



Warning label
location: rear panel/weld joint



Product label
Position: rear panel

2.2 Relevant regulations and standards

2.2.1 Product Function Security

Electrical safety	EN 61010 - 1:2010
Laser safety	EN 60825 - 1:2014 CDRH 21 CFR 1040.10

Optical cable protection disconnect (fiber interlock) : The optical cable protects the loop that allows the fiber laser to interlock with an external device (such as a hand-held weld). The laser welding system will continuously monitor this signal and terminate the external device (such as a weld) if the fiber connector is not properly connected.

The hand-held laser welding system provides a protective signal output according to the cable contained in the optical fiber cable between the laser device and the hand-held welding joint. If the optical cable is not inserted into the weld or is disconnected, the optical cable safety interlock loop will open.

Stop start guarantee: install and various electronic sensors inside the system, if abnormal conditions are detected, the monitoring program will alarm, the system will stop and continue to start;

Safety start/restart button (emergency stop) : used for emergency shutdown and recovery of laser welding system. Key switch: start/close the main loop power supply of laser welding system.

2.2.2 Classification of laser products

According to government and industry standards, all lasers are classified according to their output power or energy and laser wavelength.

According to IEC/EN 60825-1, this product belongs to high power four class laser. This product can put up to 1500W of non-visible infrared light. This level of laser can cause eye or skin damage. Although the output light is invisible, it can still cause irreversible corneal damage. This product does not provide a laser safety blindfold, but be sure to wear a proper protective blindfold when using the laser product to avoid injury.

Class FOUR lasers - High power lasers are the worst of all laser hazards. Take precautions to prevent accidental exposure resulting in direct and reflected light injury.

Diffuse and specular reflections can cause severe retinal and corneal damage, leading to permanent eye damage. Four laser beams are also a potential fire hazard and skin hazard. All personnel must wear proper eye protection when operating the device. For information on laser safety glasses, see Section 2.2.3.

The use of control, adjustment or implementation of procedures other than those specified in this user guide may result in exposure to hazardous radiation.

2.2.3 Laser safety

Wear appropriate laser safety glasses when operating the device. Selecting the right laser safety glasses requires the end user to accurately identify the wavelength range emitted by the product.

In the vicinity of the laser output aperture, there are usually many different angles of secondary laser beam. These beams are called "specular reflections," which are created when a laser beam is reflected off a surface from the main beam. While these secondary beams may be less powerful than the total power emitted by the laser, they are strong enough to cause damage to the eyes, skin and materials around the laser. If the device is a tunable resonant laser or a Raman product, it will emit light in a range of other wavelengths. The end user should confirm that the laser safety glasses used are capable of protecting the entire wavelength range of light emitted by the device.

Be careful to avoid/reduce specular reflections. The product emits invisible laser radiation at or near the wavelength of 1070nm (infrared). In addition, the product emits visible laser radiation at or near 600-700nm (red).

Check the safety label on the product to ensure that the personal protective equipment (such as enclosures, viewing Windows or holes, glasses, etc.) used is adequate for the power output and wavelength range. The decision on safety glasses must also take into account secondary radiation hazards arising during welding

Laser safety glasses must meet international safety standards, including ANSI Z136.1 (USA) and EN207/EN208/EN60825 (Europe). Effective regulations will depend on the location of the laser device.

2.3 Laser welding

Eye protection is required during laser welding to protect your eyes from any reflection or scattering of class 4 laser beams, as well as to protect the welding from strong light, ultraviolet light, heat and sparks.

For laser welding, it is not enough to wear personal protective equipment that protects against laser infrared wavelengths. A combination of face mask, helmet and/or goggles will provide the best protection during laser welding. For example, an additional welding helmet (with appropriate filters) should also be worn over laser safety glasses to protect the wearer from ultraviolet and visible radiation. Welding helmets also protect welders from heat spatter, metal particles and sparks. So people working near laser welding areas must wear personal protective equipment.

Exposure to infrared and ultraviolet radiation during welding can damage the skin. Depending on the intensity of infrared light, skin damage may include thermal burns or excessive dryness. Exposure to UV rays can cause skin burns similar to those from the sun, and can increase welders' risk of skin cancer, accelerate the signs of skin aging, and welding sparks can also cause burns.

Laser material processing can transfer a large amount of energy to parts. Even after the cutting or welding process is completed, the parts can be very hot. Be sure to use proper personal protective equipment to prevent potential burns. Wear protective clothing such as fireproof gloves, fireproof hats, leather aprons, and other fireproof clothing to prevent skin damage. Button the sleeves and collar!

2.4 Welding safety and hidden dangers

2.4.1 Fire hazard

Heat and sparks generated during welding may cause a fire or explosion if combustible or flammable material is present near the welding area. Excise welding can only be performed in areas of non-combustible material.

Do not weld on containers containing flammable or combustible materials. If the contents of a container are unknown, you should assume that they are flammable or combustible. Fire extinguishers should be nearby and easily accessible and personnel should be trained to use them.

2.4.2 Smoke hazard

Welding "smoke" can consist of very fine particles and gases. Welding fumes and gases are derived from welding materials or any combination of filling materials used, protective gases used, paints, coatings, chemical reactions and air pollutants. Welding fumes can adversely affect the lungs, heart, kidneys and central nervous system.

When the laser interacts with the target material (e.g., plastic, metal, composite), the target material may begin to evaporate. These fumes and particles are usually invisible but highly toxic and pose a serious health hazard.

Welding in a closed space with poor ventilation is very dangerous. The danger from toxic fumes and gases can increase rapidly, leading to coma or death by asphyxiation.

Ultraviolet light emitted during welding can react with oxygen and nitrogen in the air to form ozone and nitrogen oxides, which can be fatal at high concentrations.

Protective gases used during welding can displace air, resulting in personal injury

or death.

Keep your head away from the gas while welding. Always weld in a well-ventilated area to ensure that the air you breathe is safe. Use a flue gas extraction system to remove steam, particles and hazardous debris from the welding process area. Read and comply with safety data sheets and warning labels for all welding materials. Breathing apparatus may also be required in confined Spaces and in other situations. Routine air monitoring should be performed to determine hazardous smoke levels in the welding area.

2.4.3 Cylinder safety

Cylinders may explode if damaged or placed near the welding area. Protective cylinders should be placed where they cannot be struck or damaged. Place them away from heat, sparks, or flames. Cylinders must be stored in an upright position and secured to a fixed support. A working regulator suitable for the required gas and pressure is required. All hoses and fittings shall also be suitable for service and in good working condition.

2.4.4 Optical safety

The laser output is delivered through a window plate or, optionally, a device with an anti-reflective coating. Ensure Windows are clean and of good quality. Any dust at the end of the head assembly could burn out the window and damage the laser. Check the quality of the spot that the laser output emits at low power, then gradually increase the output power.

Never observe the laser aperture directly (such as the fiber, collimator, or scanning head) when the start button or remote start circuit is activated. Always wear appropriate laser safety glasses when operating the product. All ppe must be compatible with the output power and wavelength range listed on the laser safety label affixed to the product.

Do not directly look at the output port when supplying power to the laser product; Avoid placing lasers and all optical elements at eye level; Avoid using lasers in dark environments; When using the output (such as installing the laser head to the middle of the fixture), please turn the on button to the OFF position; As a precaution, please increase the output power gradually from low to high during the working process of this product;

When the laser is activated, do not install the laser head.

Photosensitive components in devices, such as cameras, photomultiplier tubes and photodiodes, can also be damaged by laser exposure. The light is strong enough to burn skin, clothing and paint. Lasers can cut and weld metal. Lasers can ignite volatile substances such as alcohol, gasoline, ether and other solvents. Installation and use must avoid contact with solvents or other flammable materials and gases.

2.5 Electrical Safety

The laser input voltage can be deadly. All cables and connections should be considered to be at hazardous levels. All parts of cables, connectors, or equipment housing shall be considered hazardous. Before powering the device, check that all the wiring harnesses are intact and that the welding shielding gas is on. In addition, where applicable, all connections must be secured with screws to ensure proper functioning.

Ensure that the device is grounded through the protection conductor of the AC power cable. Disconnection of any protective grounding conductor from the protective grounding terminal may result in personal injury. Only line fuses of the same type and rating, if applicable, should be replaced in order to continue to prevent fire hazards; Prohibit the use of other fuses or other materials; Before powering the device, ensure that the AC power supply voltage is correct. Incorrect use of voltage will cause equipment damage; Refer to the labels on specific models for proper power connections; No internal repairable parts; Hand over all maintenance work to qualified GW after-sales personnel; To prevent electric shock, do not remove the cover; Any tampering with the product invalidates the

warranty. In addition to mains connections, the external connections between the product and other external devices are defined by IEC 61140 as PELV (Protected extra-low voltage). The non-utility output of other equipment connected to this product shall also be PELV or SELV (Safety extra low Voltage).

2.6 Environment Security

Do not dispose of this product with household waste. Electronic equipment must be treated in accordance with district directives on electronic and electrical waste disposal. Note That all ppe must be compatible with the output power and wavelength range listed on the laser safety label affixed to the laser equipment. Operate with care, or the laser may damage the device.

The equipment is suitable for : (1) indoor use; (2) the altitude of 2000 meters below the use; (3) Overvoltage class II; (4) Dry place.

This device is not suitable for use where children are likely to be present. Keep away from shock or vibration sources. Appropriate enclosures should be used to ensure a laser safe working area. This includes, but is not limited to, laser safety signs, appropriate warning devices and training/safety procedures. Do not operate the output weld at eye level. Ensure that the laser mask is in place to protect the eyes of personnel working in the area from injury.

2.6.1 humidity

Do not use the device when the humidity is higher than 85%. (For details, see 3.1 Performance Parameters)

2.6.2 Cooling and temperature

The hand-held laser welding system is air cooled. Operating at higher temperatures will accelerate aging, increase threshold current and reduce slant rate efficiency. If the device is overheated, do not use it. Please call the 400 number for help. When the ambient temperature exceeds 50 ° C, the device will automatically alarm and limit the operation of the device.

3. Description of handheld laser welding equipment

3.1 Performance parameters of hand-held laser welding system

Optical performance parameter	
Output power (watts)	1500W
Working mode	Continuous/modulation/pulse/linear array/timing
Output power adjustment range (%)	1-100%
Output laser wavelength (nm)	1075 ± 10 nm
Power stability	< 5%
Maximum modulation frequency	50kHz
Laser response time	< 10us
Indicating laser wavelength (nm)	650
Indicated light power adjustable range (milliwatts)	<1mW
Laser conduction system parameters	
The interface type	Wire feed hand-held welding joint
Collimating focal length	50mm
Focus on the focal length	150mm
The length of the transmission	Standard length 5±0.5m (10m optional)
Job requirements	
Cooling and protective gas	An inert gas
Working environment temperature range	10 to 50 ° C
Working environment humidity range	85 degree or less
The input voltage	220VAC/50Hz/60Hz
The engine power	4.8 kW or less

3.2 accessories

Standard accessories			
project	Part number	The number of	Please note that
Manual laser welding system user guide	N/A	1	The current document
The power cord	N/A	1	For switching power supply
Hand weld	N/A	1	
Welding nozzle (s)	N/A	1	Five types of nozzles
Grounding protection cable (cable length selection)	N/A	1	The cable length is 5 meters or 10 meters
Other accessories are available for purchase			
Welding helmet	N/A	1	Welding protective helmet.
Wire feeder unit	N/A	1	Third party supply

3.3 Front view of AIR-series welding unit



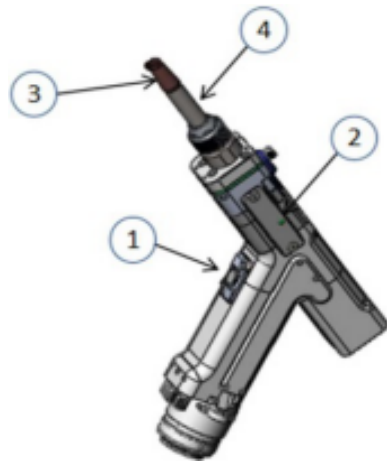
The serial number	The name	describe
1	Power key switch	Turn the key knob clockwise to (ON) to turn ON the power, and turn the key knob counterclockwise to (OFF) to turn OFF the device. When the knob is in (ON) state, the key cannot be pulled out.
2	The abrupt stop switch	In case of emergency, press the emergency stop button to quickly cut off the main loop power supply. When the stop button is pressed, clockwise rotation of the button can reset the emergency stop button.
3	A cooling fan	When the device is running, the cooling fan will be started or shut down according to the system instructions. During operation, the fan outlet should not be blocked or any foreign matter should fall into it
4	Stainless steel handle	It is used to move and carry equipment
5	Status indicator, etc	Used to indicate the running status of the current equipment: color light: system preparation;Green: Ready;Huang: Meet the safety interlocking loop, laser ready/light out state;Red: fault alarm;White: Main power supply is not ready.Blue: The system communication is abnormal
6	LOGO	Product Brand Identity
7	Air filter	It is used to filter large particle dust in the operating environment and needs to be cleaned regularly

3.4 Product Appearance Interface diagram

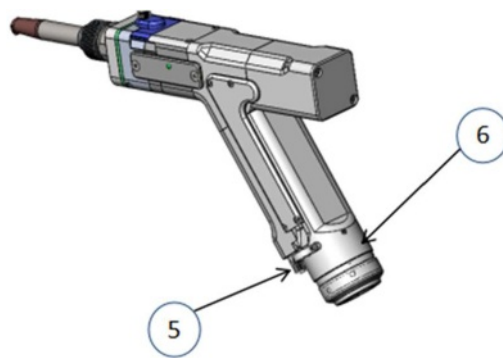


The serial number	The name of the	describe
1	WIFI antenna interface	By connecting to the Wi-Fi hotspot network, the laser can be connected to the SMAT Cloud server for system preset expert parameters update, troubleshooting and diagnosis, and remote firmware upgrade and remote after-sales services can be obtained.
2	RS232 communication interface (DB9)	It is used to connect SMATLas upper computer control software to monitor the operation of equipment, and carry out more abundant equipment control and monitoring operations.
3	User Interface (DB25)	It is used to connect the input and output of external security locks and linkage control signals.
4	Power input port of the device	AC input socket: AC 220V, 50/60Hz, 23A
5	Safety lock interface	Connect the workpiece safety clip cable to the interface. When the hand-held welding nozzle is connected to the workpiece to be welded, the safety interlocking loop between the hand-held welding nozzle and the safety clip will conduct, and then the laser emission is allowed.
6	Hand-held welding joint	The signal of the welding joint is connected to the interface through the cable, and the external use of self-winding woven net for protection.
7	Output cable interface	The laser output fiber optic cable is output through this position and connected to a hand-held welding joint (QBH output terminal). The fiber optic cable is externally protected by a self-winding network.
8	Gas imports	The protection and cooling gas inlet is connected through the 8mm gas pipe.
9	Gas outlet	Protection and cooling gas outlet, external use of self-winding network for protection.

3.5 Structure diagram of hand-held welding



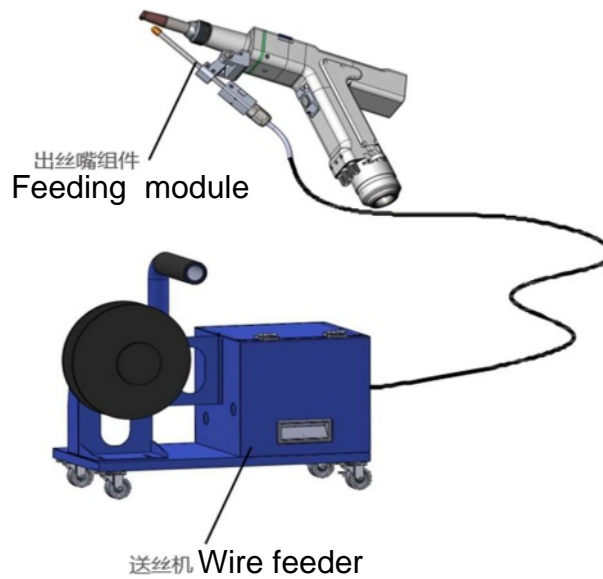
- 1, Trigger-enable laser on
- 2, Temperature monitor module
- 3, nozzle
- 4, Focus adjustment tube
- 5, Pipe connection
- 6, QBH connection



The serial number	Functional items	Description
1	Toggle button	Start the protection/cooling gas flow and start the laser emission, press the trigger to start the protection gas flow, and start the laser output according to the light out delay set by the system;The press must be maintained throughout the welding process. When the workpiece safety clip and welding nozzle do not form a conduction loop, press the trigger to allow only gas flow
2	Temperature monitoring module	Monitor welding head temperature
3	The nozzle	One standard with four spare nozzle heads;
4	Telescopic pipe	The tip of the nozzle is threaded into the pipe.
5	Protect the cooling gas connection	Connect to protect and cool gas
6	QBH optical cable connection	The cable has been inserted and connected to the welding joint.

3.5.1 Welding joint automatic wire feeding system (optional)

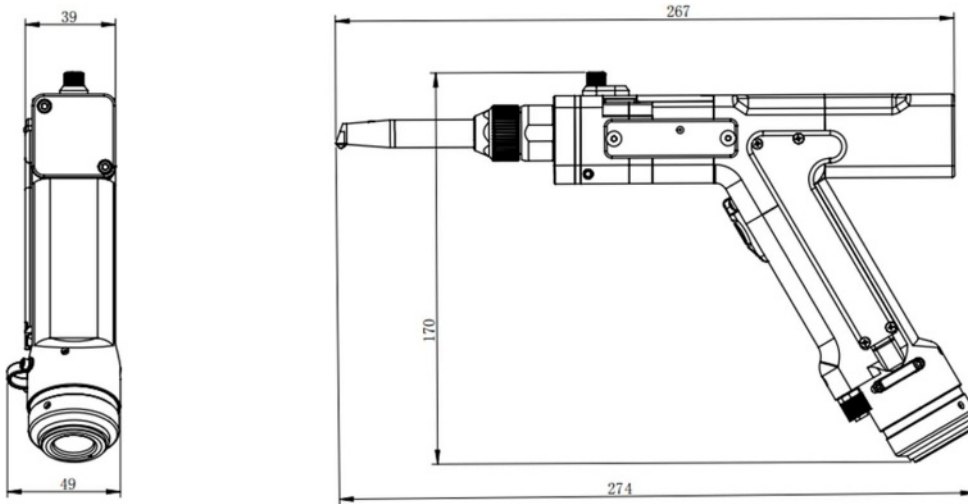
The wire nozzle support can be adjusted according to the application scenario, as shown in the following figure. Straight pipe wire feeding Angle is 40°



3.6 Product layout and Size



size	650 x 300 x 621 [mm] (L×W×H)
weight	less than 70[kg]

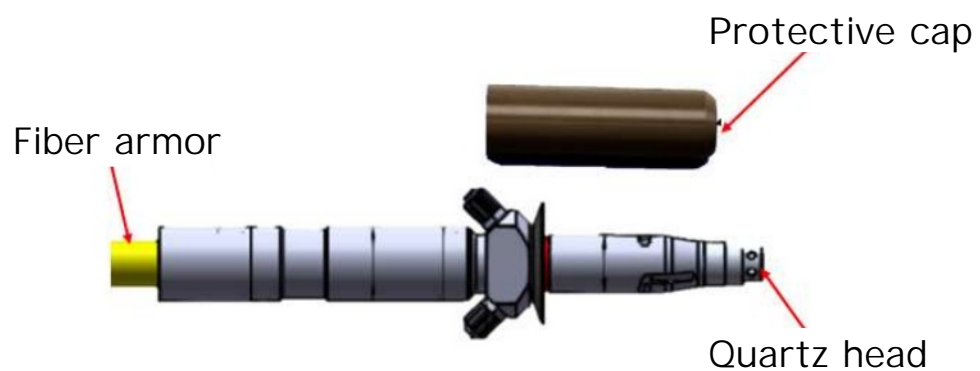


Size unit: mm

3.7 Optical Fiber Output Connection

When the product is delivered to the user for use, the fiber optic cable has been inserted and connected to the weld head. Although this is not a typical case, if it is necessary to disconnect and reconnect the fiber (for example, the weld joints need to be replaced).

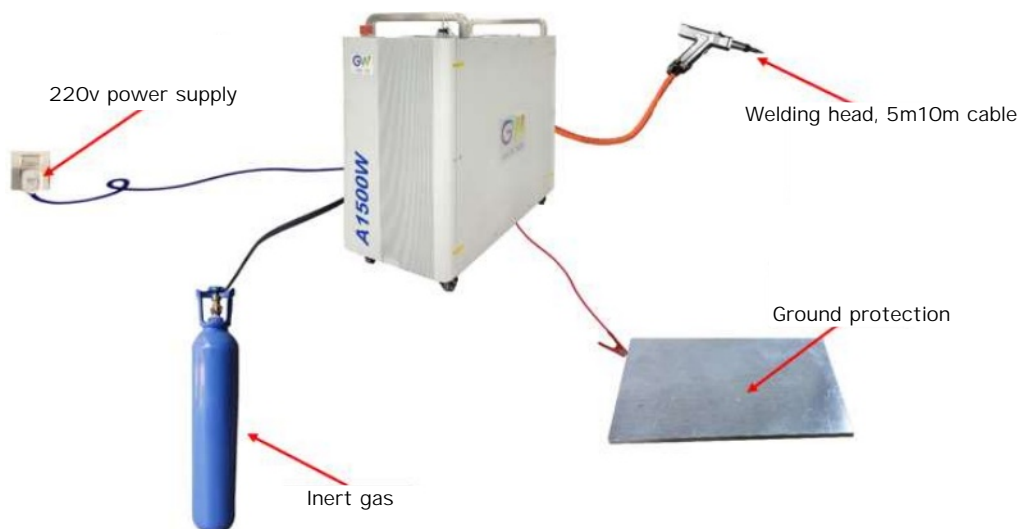
Protective caps are used at the end connectors of the optical fibers to protect the surface and electrical contacts of the optical fibers when not in use. Remove the protective cap and sleeve from the connector immediately before optical cleaning and connecting to the output weld. Each time you disconnect the optical fiber cable from the welding joint, check the optical fiber terminal for dust, dirt, or damage.



4. Install welding equipment

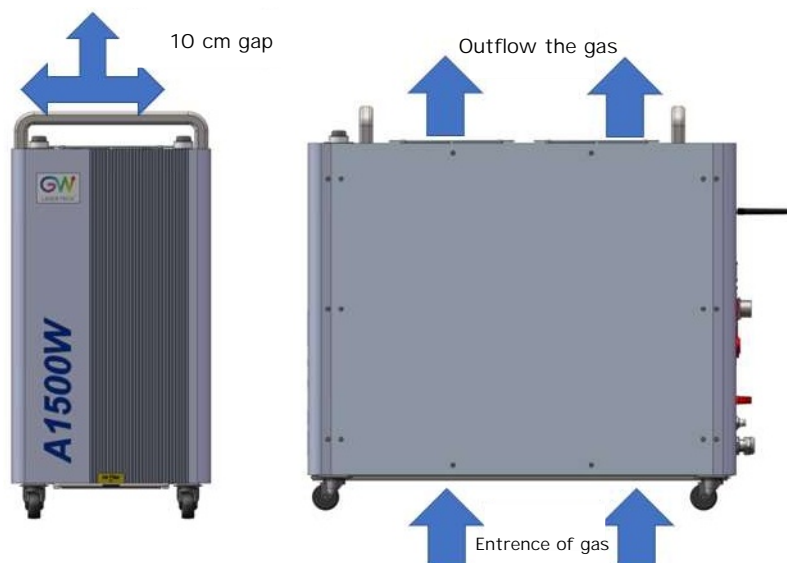
4.1 Installation Preparations

Refer to section 3.1 for electrical requirements and ensure that the input voltage is in standard phase as specified in the technical specification before switching on the power supply. The equipment must be connected with sufficient air volume of auxiliary gas to operate, in order to meet the heat dissipation of the heat load generated in the operation process, and to protect the damage caused by the spatter during the operation process to the welding joint. If the gas is not connected for operation, the equipment will automatically alarm to prohibit operation.



4.2 Air flow and installation clearance

The hand-held laser welding system adopts air cooling. When selecting the position, please run in an unsealed and narrow space with good air circulation conditions. Do not place any object that may block the exhaust on the top of the machine. The airflow direction is as shown in the figure below:



4.3 Connecting safety protection devices

The safety protection device (red terminal) is left on the rear panel of the equipment. As shown in the figure below; Before turning on the laser, the workpiece safety clip cable must be connected to the grounding protection device and the workpiece. When the hand-held welding nozzle is placed on the workpiece, the safety protection loop will be turned on and the laser is fired into the ready state. At this time, the indicator light on the device panel is orange. Only when the safety protection loop is effective, always keep the hand welding nozzle and the workpiece electrical connection (contact) to fire laser, when the safety protection loop is not on, at this time, press the trigger of the hand welding joint only to allow the auxiliary gas flow.

As shown in the figure below, the operator must connect the workpiece safety clip cable to the safety protection interface installed on the rear panel of the device. The closed loop of safety protection is effective when the hand-held welding nozzle contacts the workpiece. If the operator lifts the nozzle from the workpiece during operation, the safety loop will be disconnected and the laser will automatically close.



4.4 Auxiliary gas for connecting welding

The welding gas input port can only be connected with an 8mm gas pipe, as shown in the following figure. Insert the gas pipe into the quick connection of the gas inlet. Once connected, open the external gas valve to supply the gas. It is recommended to use inert gas during welding to protect the weld quality. The input gas pressure should be greater than 0.3bar and less than 6.0bar. The output pipe must be connected to the hand-held welding joint to work, and the external output pipe is protected by self-winding weaving net.



project	specification
Standard auxiliary gas	Argon, nitrogen and a mixture of argon and carbon dioxide
Input gas pressure	Minimum 0.3bar, maximum 6.0bar

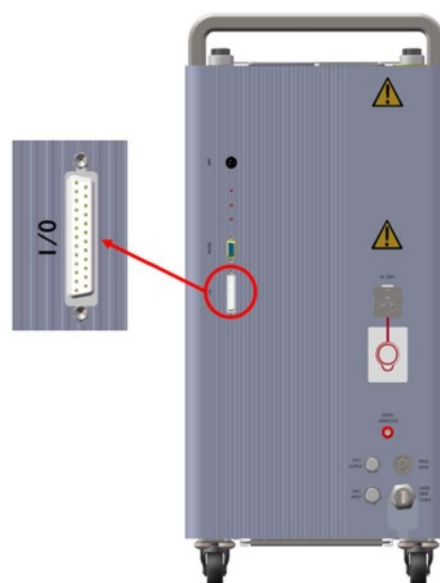
4.5 Cable connection of hand-held welding joints

The following figure shows the 12-core control cables connected to the welded joints on the rear panel. The cable has been connected to the hand-held welding joint before delivery. Do not disconnect the cable unless necessary.

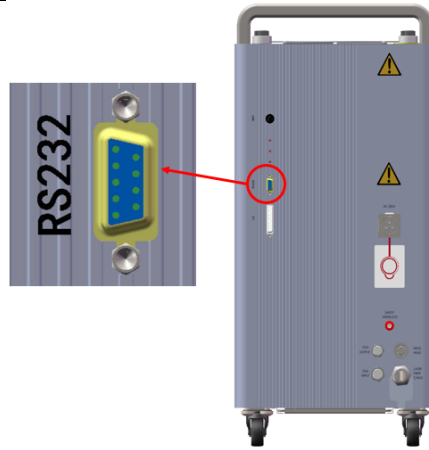


4.6 User Interface

User interfaces include DB25 computer interface for connecting external control signals, RS232 communication interface, and Wi-Fi transmission interface. Users can use the DB25 computer interface and external devices to implement security interlock control, obtain device status and alarm information, and control the execution of external devices. The RS232 interface enables users to connect to the upper computer control software to achieve richer monitoring operations. The Wi-Fi transmission interface is used to connect to the wireless hotspot, connect to the SMAT Cloud service to obtain remote firmware upgrade and remote services.



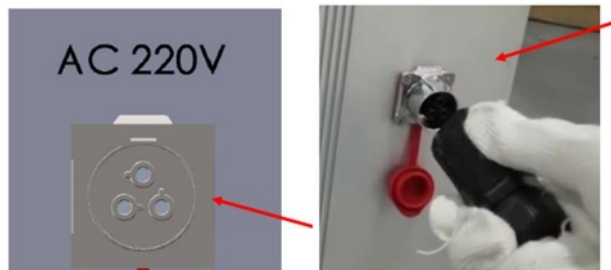
User Interface (DB 25Pin)				
Pin#	define	describe	IN/ OUT	annotation
1.14	+24V-IN	IN+24V	IN	N/C
Two, three, fifteen, sixteen	GNDD	0V	IN	Digital signal reference potential
4	S-LAS	Laser starting state	OUT	Output laser start signal (24V)
17	24V+	Ext 24V	OUT	provides 24VDC output
5	S-ERR	System error	OUT	System error output (24V)
18	S-WAR	warning	OUT	Close to alarm threshold 90% output warning signal (24V)
6	S-RDY	The system is ready	OUT	System ready state output signal
19	P-RST	reset	IN	Reset common errors
7	X-RED	Red leading light	IN	Externally controlled red guided Light activation (24V)
20	P-LPS	Pneumatic switch signal	IN	External pneumatic switch signal access (24V)
8	X-STOP	Safety interlock	IN	External safety interlock control signal, normally closed (24V)
21	X-LOCK	Safety interlock	IN	Connecting workpiece safety clamp interlocking loop (24V)
9	X-LASER	Laser launch	IN	Connect to laser start signal
22	X-GAS	Valve to start the	IN	Air valve start signal (24V)
23	L-Pout	Galvanometer control signal output	OUT	Swing head control signal output -5V-5V
11	GND	GND	OUT	Analog signal reference potential
12, 13, 24, 25	N/C	N/C		N/C



RS232 communication interface (DB 9Pin)				
Pin	define	describe	IN/OUT	annotation
2	TXD	Data output		-10V~10V
4, 7-9	NC			N/A
3	RXD	Data input		-10V~10V
5	GND	grounding		0V

4.7 Power Connection

Before connecting the power supply, ensure that the power supply capacity meets the specifications described in Section 3.1. The device comes with a RVV 3x4mm² To connect cables, perform the following steps according to the cable harness identifier:



Main power port 3-PIN			
Pin #	function	Wiring color	voltage
1	The phase line voltage	Red (L1)	220VAC
2	The zero line voltage	Black (L2 / N)	0VAC
3	grounding	Green/yellow (PE)	PE

1. Connect the power input cable to the indicated voltage, phase and frequency of 50/60Hz. L1= phase line voltage, L2= neutral line voltage, PE= ground,

2. The power input cable of the device must be connected to the dedicated AC mains through a circuit breaker that is connected to no more than 30 amperes. Mark the area easily accessible to the operator to identify the disconnecting device for power supply to the equipment;
3. Wiring should comply with all national and local codes, and electrical connections should be conducted by professional electrical safety operators.

4.8 Starting and Stopping the System

All electrical connections must be connected before powering the device. Where applicable, all connections must be secured with screws or clips to ensure proper functioning. Ensure that you wear appropriate personal protective equipment when operating this product. These include welding helmets, flame-retardant protective gloves and laser safety glasses suitable for use at 1070nm.

WARNING



When maintaining the output cable, disconnect the main power supply of the device and remove the input cable interface. Cable minimum allowable bending radius of 50mm;

System startup:

1. Ensure that all connections required for normal operation have been completed, including restrictions on external security protection devices. At the same time, check that the safety protection loop is connected properly and the external safety interlocking loop is closed.
2. Make sure the emergency stop button is not pressed. If pressed, the emergency stop button can be reset by turning clockwise.



3. Turn the key clockwise to the position of (ON);



5. After startup, the indicator on the panel and the display screen will be lit. During startup, the indicator light will be in color flow state.

* If other status is displayed, refer to section 3.3 description or Section 7.1 error information. If this cannot be ruled out, contact the service personnel.

System shutdown:

If you want to close the laser welding system, the user must stop firing the laser after the completion of the welding; 1. Release the trigger of the handheld head, at this time, the system will stop firing the laser and stop the gas flow (if the gas extension shutdown parameter is set, it will stop after the set time). Turn the key switch counterclockwise to the (OFF) position and remove the key from the product and secure the key to prevent unauthorized use.


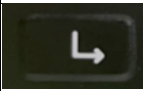


5. Operate laser welding system

5.1 Operations on the Control Panel

The device operation panel consists of four buttons and an LCD screen for viewing device status, device information, and adjusting system operating parameters.



A. Button Function introduction:

Button in the legend	Functional description
 menu	In case the user interface is not a status page, the upper-level menu used to return to the currently displayed page. Continuous clicking will eventually return to the status page.
 Identify key	It is used to confirm the parameter selection, enter the advanced parameter setting interface, and save the modified parameter number.
 The up key	Select the menu of the user interface and add parameters. Long press on the parameter selection and parameter adjustment pages to add the parameters in an increment of X10.
 Down keys	Select the menu of the user interface and reduce parameters. Long press on the parameter selection and parameter adjustment pages to reduce the operation by x10 increment.

B. Introduction to user Interface:



Menu navigation area

Content display area

The user operation interface is divided into the menu navigation area and the content display area, as shown in the preceding figure. The displayed content changes according to user operations. After the device is started, the status page is displayed by default to display the current running information of the device. The up and down buttons on the panel allow you to switch between different menu pages.

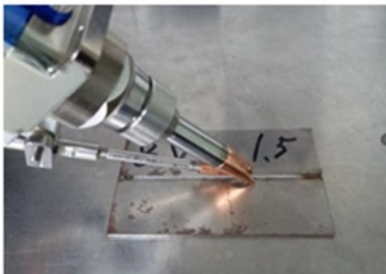
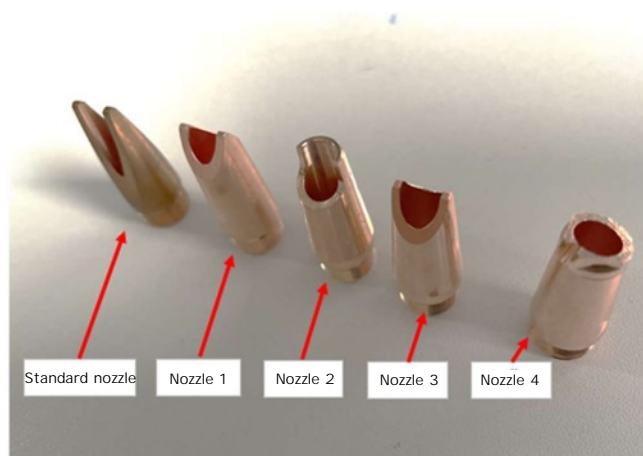
5.2 Operation of welding joint

5.2.1 Install the nozzle

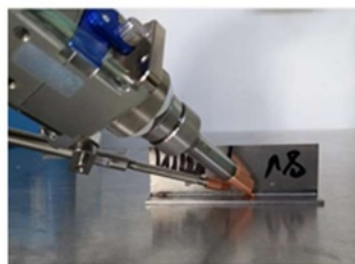
Before replacing the nozzle tip, close the device nozzle tip to thread to the extension pipe of the welded joint.



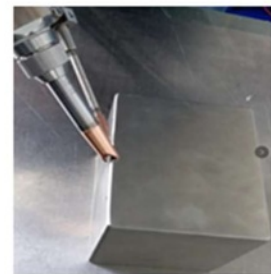
There are five types of nozzles, as shown below:



Nozzle 1 (for plane welding)



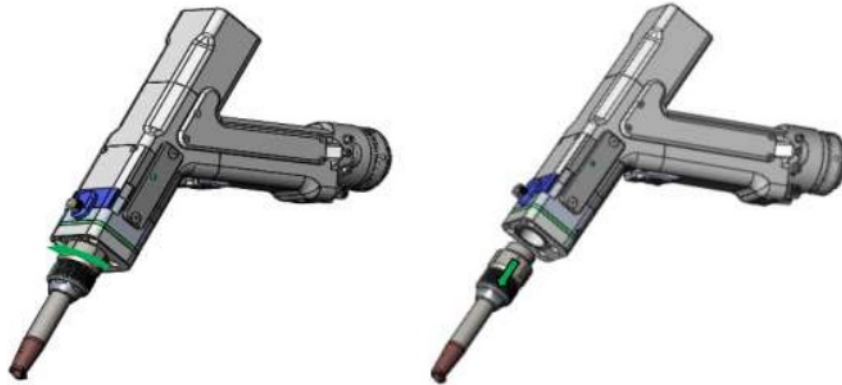
Nozzle 2 (for inner corner welding)



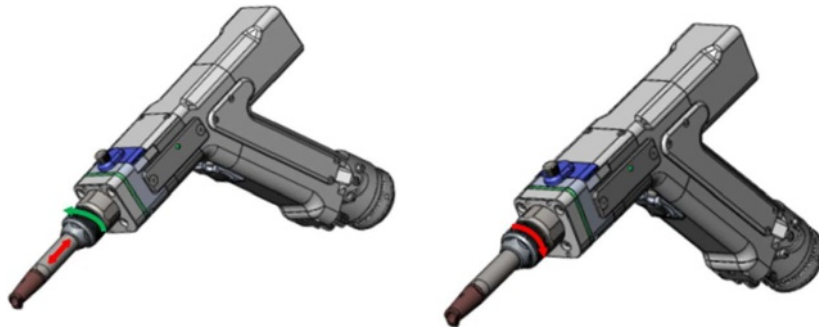
Nozzle 3 (for outside corner welding)

5.2.2 Adjust the nozzle tube

Before adjusting the nozzle tube, please use the key switch button to close the unit. Loosen the nut when adjusting the nozzle tube, as shown in the figure.



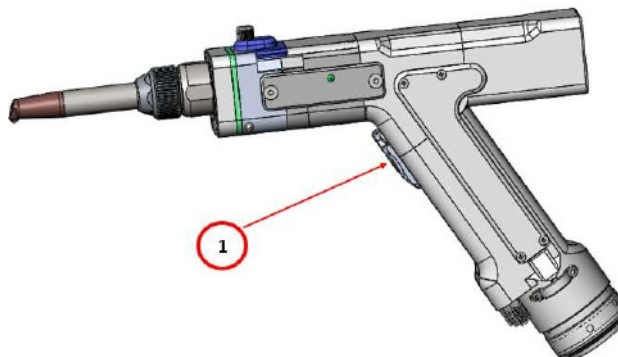
Once positioned correctly, tighten the nut and lock the nozzle tube into place as shown. Please hold it tight with your hands!



5.2.3 Operating hand-held welding joints



Laser warning!



Pressing trigger 1 on welding head will open shielding gas. The shielding gas will continue to hold for 2 seconds (the gas delay time can be configured through the "exhaust delay" parameter) before the laser starts. The premise of laser emission is to meet all safety interlock control conditions and set the gas after the end of the time delay. During welding, the operator must keep the switch pressed to keep the laser firing. Release trigger 1 or failure of safety interlocking loop will stop laser emission.

5.3 Important Security Functions

5.3.1 Interlocking optical cable connections

Optical fiber interlock is a safety protection loop between the hand-held welding joint and the optical cable interface of the equipment. It is used to limit the laser emission of the equipment in the case of not connecting the external optical device. It is a method to ensure the interlock protection between the optical cable output interface and the hand-held welding joint. If the output optical cable of the device is not correctly connected to the welding joint, do not emit laser. At the same time, the system displays the interlocking status of the output signal on the user interface to inform the user whether the current loop is normal.

5.3.2 External security interlocked loop

The laser welding system includes an external safety interlock circuit, and the user operator can connect the safety grating, safety door and other safety protection equipment. External interlocking requires an external user interface to be connected and the security loop to be kept closed at all times (see section 4.6 interface definition). If the dry contact signal is used, on the DB25 pin connector: pin 8 is connected to pin 17), otherwise the laser emission will be prohibited, the welding system will output alarm information, the panel status light will show red, and the user interface will also inform the user through the alarm code.

5.3.3 Safety protection loop between workpiece safety clip and hand-held welding joint

The safety loop is designed to ensure that the hand-held weld is allowed to emit laser light only when the nozzle is connected (in contact) with the workpiece. The operator must secure the workpiece safety fastener to the metal workpiece to be machined. When the nozzle of the welding joint touches the workpiece, the loop between the nozzle of the welding joint and the workpiece safety clamp will be activated. If the operator removes the nozzle from the workpiece, the safety interlocking loop will be disconnected, the laser will automatically close and the laser will not be fired.

5.3.4 Limitations of buttons on the handheld head

When the trigger button on the hand-held laser welding head is opened in the safety interlocking loop, if the user presses the trigger button, only the auxiliary gas valve is allowed to open and the airflow is allowed to pass through the welding nozzle, but the laser is not allowed to fire and the set operation program is not allowed. If full foot the safety interlock condition, the trigger button will serve as the program runs the trigger device, when the user presses the trigger button, gas delay will be executed first set, gas delay time will be implemented according to the parameters set by the user, the gas delay after the execution will launch the excitation light, in order to complete the welding work, the operator must keep the trigger button, so that the laser emission remain open.

5.3.5 User operation status and system running Status

It is assumed that under the above state of security protection interlocking, user operations and system operating states are as follows:

The serial number	User operation (safety interlocking loop is closed)		The laser	Indicator light	Swing beam	Auxiliary gas
1	Workpiece safety clip trigger button	Disconnect the loosen	Shut down	Open	Shut down	Shut down
2	Workpiece safety clip trigger button	Disconnect the press	Shut down	Open	Shut down	Open
3	Workpiece safety clip trigger button	Conduction loosen	Shut down	Open	Open 1	Shut down
4	Workpiece safety clip trigger button	Conduction press	Open 2	Open	Open 1	Open

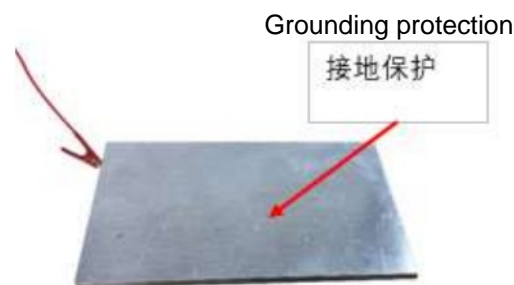
^{#1}The beam will swing according to the set value only if the user sets the swing width, otherwise it will remain fixed.

^{#2}If the program is set to close the air delay, the laser will not be fired immediately when the trigger is pressed, and the laser will be fired only after the end of the set air delay, which is the normal operation state.

5.4 Starting Welding

All personnel in the welding area must wear personal protective equipment to protect against invisible infrared lasers and any secondary visible and invisible radiation generated during the welding process. Appropriate laser safety glasses and welding helmet with appropriate filters are required. Safety equipment for welding operators also includes welding helmets and fire protection suits and gloves.

1. Check whether the safety loop is working properly. If the safety loop is not working properly, the indicator on the panel will display a red alarm and corresponding alarm code.
2. Select a suitable welding nozzle and install the nozzle on the extension pipe of the welding head;
3. Select the preset parameters (see section) s.01 on the user interface to process the aluminum sheet with a thickness of 1mm in cw laser mode.
4. Place the workpiece to be welded on the welding workbench and clamp and fix it. In laser welding work, it is necessary to ensure that there is a minimum gap between parts and as close contact as possible.
5. Ensure that the "workpiece safety clip" is connected to the part or the conductive welding table where the part is placed. See the figure below



6. Touch the tip of the nozzle to the part being welded. This closes the safety interlocking loop between the workpiece safety clip and the hand-held weld, with the device in the ready working state and the device indicator orange.
7. Press the trigger button on the hand-held welding head to trigger the protective gas and wait for the laser to start.

8. When the laser is fired, the welding joint can be moved slowly to complete the welding operation. The trigger button of the welding joint should be kept pressed during the welding process, otherwise the welding process will be interrupted and the laser will be stopped. The equipment indicator light will always show orange during the working process.

9. Since the infrared laser beam is not visible, use the red guide beam to position the nozzle correctly on the part. The following picture shows the proper Angle to hold the welded joint when positioning the nozzle to the part being welded.











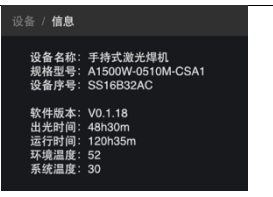
To further improve the process, operators can use buttons on the LCD panel to adjust some process Settings by increasing or decreasing laser power, swing frequency, swing width, and other parameters.

6. User interface function introduction and process parameter setting

6.1 Introduction to the UI menu structure

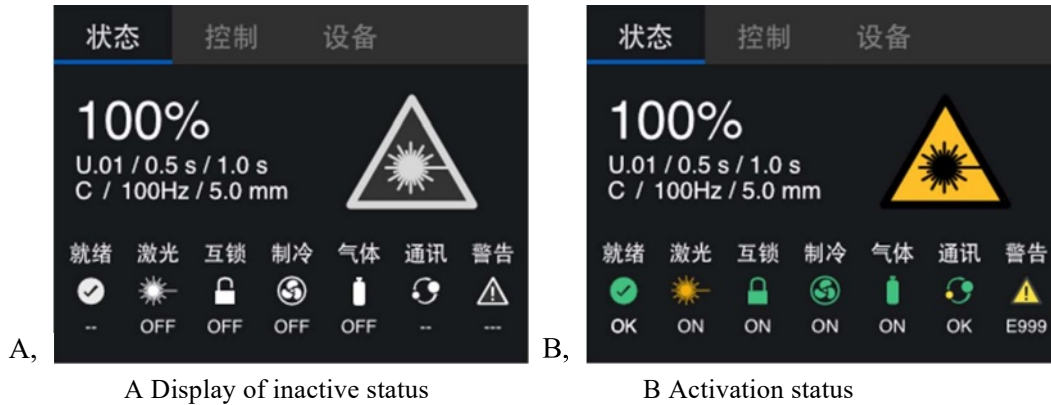
The user interface is mainly composed of status page, control page and device page. The following table briefly describes the hierarchy and function description:

Level 1 page	Secondary pages	Interface to preview	Functional description
state			This interface is used to centrally display information such as the running parameters and status of the current device. It is displayed by default after the device is started.
control			Users can enter the process parameters through the control page, which includes users Parameter, preset parameter, air outlet delay, air off delay menu entry, When the " " flag is displayed in the upper right corner, the single point of confirmation button activates the current selection Select, long press the "confirm" button to enter the parameter editing page Click the "Confirm" key to enter the modification.
	User preferences		On the user parameter selection page, the user can select the parameter number through the upper and lower buttons in the operation panel, and the single confirm button can save the former number. To adjust other Settings of the selected parameters, long press the CONFIRM button to enter the detailed setting interface. Refer to the function description in Section 6.3.1
	Preset parameters		On the user parameter selection page, the user can select the parameter number through the upper and lower buttons of the operation panel, and the single click of confirm button can save the previous number. Long press the CONFIRM button to enter the detailed setting interface. The preset parameters are the default parameters of the system, and only part of the setting options are opened to the user. For details, see section 6.3.2
	Gas delay		On this interface, the air outlet delay before laser emission can be set to release the auxiliary gas in advance. When the trigger button of welding joint is pressed, the gas will be released according to the set time and then the laser will be started.

	Air supply delay		<p>On this interface, you can set the delay of closing the gas after the laser is stopped to release the auxiliary gas continuously. When the trigger button of the welding joint is released, the gas will be released according to the set time and then the program will be finished. During the execution, the laser is in the closed state.</p>
equipment			<p>The device page is an entry for users to view device information</p>
	Service code		<p>This interface will display the unique service code of the device, which is mainly used to identify the characteristics of the device service</p>
	information		<p>This page displays device operation information, including software version information, environment information, hardware information, etc.</p>
<p>The functions of each interface are described in the following sections.</p>			

6.2 Using the User Interface Status Page

The user page is displayed by default after the device starts. If the user page is on another page, you can click the Menu button to return to the status page layer by layer.











A,

A Display of inactive status

B,

B Activation status

Display content (inactive, active)	describe																								
	<p>This area displays the setting content of the current operating parameters of the device. The first line of percentage shows the power ratio of the current device, and the second line is separated by "/" to display the program number/air outlet delay/air off delay selected by the user. The content in the third line is separated by "/", and the content and definition vary in different running modes (see table below) :</p> <table border="1"> <thead> <tr> <th>The operation mode</th> <th>Model code</th> <th>Display parameter 1</th> <th>Display parameter 2</th> </tr> </thead> <tbody> <tr> <td>Continuous mode</td> <td>C</td> <td>Oscillation frequency</td> <td>Swinging width</td> </tr> <tr> <td>Modulation mode</td> <td>M</td> <td>Oscillation frequency</td> <td>Swinging width</td> </tr> <tr> <td>The pulse mode</td> <td>P</td> <td>The pulse width</td> <td>Swinging width</td> </tr> <tr> <td>Linear array pattern</td> <td>S</td> <td>Medallion time</td> <td>GuanGuang time</td> </tr> <tr> <td>Timing mode</td> <td>T</td> <td>The duration of the</td> <td>Swinging width</td> </tr> </tbody> </table>	The operation mode	Model code	Display parameter 1	Display parameter 2	Continuous mode	C	Oscillation frequency	Swinging width	Modulation mode	M	Oscillation frequency	Swinging width	The pulse mode	P	The pulse width	Swinging width	Linear array pattern	S	Medallion time	GuanGuang time	Timing mode	T	The duration of the	Swinging width
The operation mode	Model code	Display parameter 1	Display parameter 2																						
Continuous mode	C	Oscillation frequency	Swinging width																						
Modulation mode	M	Oscillation frequency	Swinging width																						
The pulse mode	P	The pulse width	Swinging width																						
Linear array pattern	S	Medallion time	GuanGuang time																						
Timing mode	T	The duration of the	Swinging width																						
	<p>When the laser is in the state of waiting to be fired or fired, the icon will be shown as yellow background, otherwise, the laser is in the state of waiting to be fired or fired.</p>																								
<table border="1"> <tr> <td>就绪 --</td> <td>就绪 OK</td> </tr> </table>	就绪 --	就绪 OK	<p>After the system is started, the cooling system is normal, the gas input is normal, the communication is normal, the safety interlocking loop is closed, and the ready icon is activated when no other alarm is generated</p>																						
就绪 --	就绪 OK																								
<table border="1"> <tr> <td>激光 OFF</td> <td>激光 ON</td> </tr> </table>	激光 OFF	激光 ON	<p>When the laser is in the state to be fired or when the laser is fired, the icon will be activated. At this time, the operator and the peripheral user should do a good job in safety protection. Please refer to section 5.4</p>																						
激光 OFF	激光 ON																								
<table border="1"> <tr> <td>互锁 OFF</td> <td>互锁 ON</td> </tr> </table>	互锁 OFF	互锁 ON	<p>The icon will be activated when all safety loops are closed</p>																						
互锁 OFF	互锁 ON																								

 制冷 OFF	 制冷 ON	<p>After the system is powered on, it takes some time for the cooling system to start up. Generally, the startup time is within 30 seconds. When the cooling system is started up, this icon will be activated</p>
 气体 OFF	 气体 ON	<p>After the external auxiliary gas is connected to the device, the diagram will be activated if the access pressure meets the system requirements (as described in Section 4.4). The input gas pressure should be greater than 0.3bar and less than 6.0bar</p>
 通讯 --	 通讯 OK	<p>This icon is only used for the communication status of internal control signals in the system. When the communication status of internal signals is normal, the icon becomes active</p>
 警告 ---	 警告 E999	<p>When a fault or alarm occurs in the system operation, this icon will be activated and all fault codes will be displayed scroll below the icon. Users can record the fault codes and refer to the content in Section 7.1 for information comparison.</p>

6.3 Using the User Interface Control Page

The control page contains four options, which are user parameters, preset parameters, air outlet delay and air off delay. After entering this page, enter the parameter selection state through the "Confirm" button in the single-point operation panel. You can select parameters through the up button or down button in the operation panel. When a parameter is selected, the background color will be blue. "Confirm button" enters the parameter setting interface.



注：当“≡”在右上角显示时，操作面板中的确认按钮将激活当前选择。在操作面板中长按确认按钮以进入参数编辑页面。

6.3.1 Setting User Parameters

The system provides the user with the running program which can customize the parameters, the number is U.0 to U.19, a total of 20 groups. The operator can arbitrarily select a set of programs to modify until the work needs are met, and the parameters set by the user will be saved in the system by default, so as to be reused next time.

Specific steps for entering parameters:

Select user parameters on the control page, hold down the confirm button in the operation panel, and wait for 0.5 seconds to enter the program selection page.



In the user program, parameter selection page, up and down through the operation panel button can be used to increase or decrease the number of the current program and program number increase when continued to press the up button to U. 19 will stop when continues to press the button down program to reduce the number of U. 00 will stop, when the adjustment to the required procedure number, single point operation panel of the confirm button, can activate the choice of the current program, at the same time show the green icon on the right Angle ", "said is activated.



To modify the selected program number, long press the confirm button in the operation panel for more than 0.5 seconds to enter the detailed parameter device page.



In user program mode, before entering parameter setting, it is necessary to confirm the running mode selected by the current program. The system provides users with five running modes to choose.

- Continuous mode - for continuous welding of most sheet metal (see Section 6.3.1.1)
- Modulation mode - for welding of sheet metal (see Section 6.3.1.1)
- Line-array mode - For line-segment welding (see section 6.3.1.1)
- Pulse mode - for welding of highly reflective materials (see Section 6.3.1.1)
- Timing mode - for inching welding (see Section 6.3.1.1)

Here we take the linear array mode as an example to describe the method of parameter setting in detail. According to the previous operation method, select the linear array single point confirm button to activate the linear array mode, and the green icon will be displayed in the upper right corner. Long press the "Confirm button" in the operation panel for 0.5 seconds to enter the parameter setting page of "Linear array mode".



After entering the parameter selection page, the single confirm button can enter the parameter adjustment operation. The adjustment range of each parameter is different. On the adjustment interface, take changing laser power as an example to adjust the laser power from 85% to 100%



Press the upward button on the operation panel to adjust the setting value to 100%. After the adjustment is complete, the single point confirmation button is used to save the Settings.



Click the menu button to return to the previous page, and you can see that the laser power setting value is displayed as 100% after modification. At this time, the modification result has taken effect.



According to the above method, the user can continue to complete the modification of all parameters in the current program. If you need to save the modified program in the system for use after the next startup, you need to continuously press the menu key to return the page to the page for program number selection. All the modified parameters in the current program will be automatically saved in the system for the next call. If you turn off the power on the parameter modification page, all changes in the program will not be saved.

6.3.1.1 Description of the running mode in the program

The system provides five operating modes for users to choose.

continuous mode - Used for continuous welding of most sheets of metal

The serial number	Parameter names	unit	The minimum value	The maximum	Adjust the volume	The default value	describe
1	Laser power	%	0	100	1	100	
2	Oscillation frequency	Hz	0	300	1	0	
3	Swinging width	mm	0	5	0.1	0	
4	Slow rise time	ms	0	2000	1	500	
5	Slow down the time	ms	0	9999	1	500	

Parameter definitions are described in the glossary in Section 6.3.1.2

modulated mode - used for welding sheet metal

The serial number	Parameter names	unit	The minimum value	The maximum	Adjust the volume	The default value	describe
1	Laser power	%	0	100	1	100	
2	Oscillation frequency	Hz	0	300	1	0	
3	Swinging width	mm	0	5	0.1	0	
4	Pulse frequency	Hz	1	50000	1	500	
5	The pulse width	%	10	100	1	50	
6	Pulse waveform	#	0	19	1	0	Zero is infinity

Parameter definitions are described in the glossary in Section 6.3.1.2

Linear array mode - for segment welding

Serial number	Parameter name	Unit	Minimum value	Maximum value	Adjustment amount	Default value	describe
1	Laser power	%	0	100	1	100	
2	Swing frequency	Hz	0	300	1	0	
3	Swing width	mm	0	5	0.1	0	
4	Slow rise time	ms	0	2000	1	500	
5	Slow down time	ms	0	9999	1	500	
6	Switch time	ms	0	3500	1	500	
7	Light off time	ms	0	3500	1	500	
8	Repetitions	#	1	9999	1	0	

Parameter definitions are described in the glossary in Section 6.3.1.2

Tailor pulse mode - for welding of highly reflective materials

The serial number	Parameter names	unit	The minimum value	The maximum	Adjust the volume	The default value	describe
1	Laser power	%	0	100	1	100	Less than 2 times the standard power
2	Oscillation frequency	Hz	0	300	1	0	
3	Swinging width	mm	0	5	0.1	0	
4	Pulse frequency	Hz	0	50000	1	500	QCW operation restrictions are met
5	The pulse width	%	10	100	1	50	QCW operation restrictions are met
6	Pulse waveform	#	0	19	1	0	Zero is infinity

Parameter definitions are described in the glossary in Section 6.3.1.2

Slim Timing mode - used for spark welding

The serial number	Parameter names	unit	The minimum value	The maximum	Adjust the volume	The default value	describe
1	Laser power	%	0	100	1	100	
2	Oscillation frequency	Hz	0	300	1	0	
3	Swinging width	mm	0	5	0.1	0	
4	Slow rise time	ms	0	2000	1	500	
5	Slow down the time	ms	0	9999	1	500	
6	Switching time	ms	0	3500	1	500	
7	GuanGuang time	ms	0	3500	1	500	

Parameter definitions are described in the glossary in Section 6.3.1.2

6.3.1.2 Parameter glossary of operation mode

The serial number	The parameter name	unit	Parameters are defined
1	Preset parameters		Is the default process parameter of the system. Some parameters in the program are allowed to be modified by users. The latest process parameter set can also be updated through remote service.
2	Application no.		Refers to the process parameters selected by the current user. The user parameters include 20 groups of customizable programs, and the preset mode includes 55 groups of process parameters
3	The operation mode		The current operation of the device, specifying the set of parameters that the user will use in the program
4	Laser power	%	Sets the maximum output power of the system. In discontinuous mode, it is used to set the amplitude of the maximum output power of the device.
5	Oscillation frequency	Hz	Set the scanning frequency of the beam deflection mirror in the hand-held welding joint. The device frequency is output in the form of triangular wave. The higher the setting frequency is, the faster the scanning speed will be, and the lower the setting frequency will be.
6	Swinging width	mm	Set the Angle value of the deflection mirror in the hand-held welding joint to limit the width of the beam movement. The maximum swing width is set to 5mm. When set to 0, the deflection mirror will no longer move.
7	Slow rise time	ms	It is effective under the operation modes of "continuous mode", "linear array mode" and "timing mode". It is used to set the slow rise interval from 0% to the set power value after the laser emission takes effect. The result is that the laser output intensity changes from weak to strong.
8	Slow down the time	ms	It is effective in the operation mode of "continuous mode", "linear array mode" and "timing mode". It is used to set the slow decline interval of the power from the set power value to the complete shutdown after the laser is fired off. The result is that the laser output intensity has a change time of strong and weak.
9	Pulse frequency	Hz	In modulation mode and pulse mode, set the pulse running period of the laser output
10	The pulse width	%	In modulation mode and pulse mode, set the effective output interval for each pulse running cycle. When the pulse width is set to 100%, it is equivalent to continuous mode. In pulse mode, the maximum pulse width limits the power set.
11	Medallion time	ms	In line array mode, determine the time for the laser to remain firing after the start time.
12	GuanGuang time	ms	In the online array mode and timing mode, determine the time for the laser to keep firing after the start time.
13	The duration of the		In timing mode, determine how long the laser stays firing after the start time.
14	Repeat the number		In online array mode, set the number of repeated runs of the whole program cycle, and stop the program execution when the run reaches the set number

15	waveform		In the modulation mode and pulse mode, users can choose different pulse waveforms to adjust the transmitting mode of the pulse. The default waveform 0 is not changed. After other waveforms are selected, the maximum output power rate will be adjusted with the preset waveform curve.
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6.3.2 Setting Preset Parameters

The preset parameters in the system have 55 groups of programs, numbered s. 00 to S.54. The program in the preset parameter is the default program of the system, and the user can choose a set of programs to modify. However, compared with the user parameter, the operator can only modify the specific parameters in the operation mode set by the system program and fine-tune the parameters. The parameters set by the user will also be saved in the system by default for repeated use next time.

Specific steps for entering parameters:

Select preset parameters on the control page, hold down the confirm button in the operation panel, and wait for 0.5 seconds to enter the program selection page.



Parameters in preset program selection page, up and down through the operation panel button can be used to increase or decrease the number of the current program and program number when continued to press the up button to s. 54 will stop, when continues to press the button down program number is reduced to s. 00 will stop check, when the adjustment to the required procedure number, single point operation panel of the confirm button, can activate the choice of the current program, right Angle at the same time show the green icon ", "said is activated.



To modify the selected program number, long press the confirm button in the operation panel for more than 0.5 seconds to enter the detailed parameter device page. In the preset program mode, you will directly enter the parameter setting page according to the operating mode set by the system default.



As shown in the figure above, the default operating mode of S.01 is continuous mode. In continuous mode, the parameters that can be set are only laser power, swing frequency and swing width.

Under the preset parameters, the default operating mode of the system program can be adjusted as shown in the following table:

The operation mode	Continuous mode	Modulation mode	The pulse mode	Linear array pattern	Timing mode
Adjustable parameter	power	power	power	power	power
	Oscillation frequency	Pulse frequency	The pulse width	Switching time	Slow down the time
	Swinging width	Swinging width	Swinging width	GuanGuang time	The duration of the

After entering the parameter selection page, the single-point confirmation button can enter the parameter adjustment operation. The adjustment range of each parameter will be different. The method of parameter adjustment is the same as that of user parameters.

Please refer to the following table for quick selection of welding application range of preset parameters of the system and user parameters

Preset parameters apply the quick query table						
Material and working mode		The 0.5 mm	1mm	2mm	3mm	4mm
Stainless steel	Continuous mode	S.00	S.01	S.02	S.03	S.04
	Modulation mode	S.05	S.06	S.07	S.08	S.09
	With wire feeding	S.10	S.11	S.12	S.13	S.14
Carbon steel	Continuous mode	S.15	S.16	S.17	S.18	S.19
	The pulse mode	S.20	S.21	S.22	S.23	S.24
	With wire feeding	S.25	S.26	S.27	S.28	S.29
aluminum	Continuous mode	S.30	S.31	S.32	S.33	
	The pulse mode	S.34	S.35	S.36	S.37	
	With wire feeding	S.38	S.39	S.40	S.41	
brass	Continuous mode	S.42	S.43	S.44	S.45	

	The pulse mode	S.46	S.47	S.48	S.49	
copper	Continuous mode	S.50	S.51	S.52		
	The pulse mode	S.53	S.54	S.55		

6.3.3 Setting of air outlet delay and air closing delay

The output delay and shutdown delay are global parameters of the system. After modification by the user, all user programs and preset programs will be executed according to the modified Settings. The setting range of air outlet delay and air closing delay is 0-3000ms. The methods for setting the two parameters are the same. This section uses the air outlet delay as an example to describe how to set the two parameters

The specific steps for setting parameters are as follows:

Use the up or down button of the operation panel to switch the page to the control page. Click the OK button to enter the parameter selection state. Click the up or down button to select the parameter of "Exhaust delay" and enter the parameter adjustment page with the single click of the OK button



Adjust the air outlet delay to 1500ms. If it is not saved, you can press the menu button to return to the previous page. If you need to save the modified parameters, click the confirm button to save the parameters.



6.4 Viewing the Device Page

The Device page contains two options: Service Code and Device Information. After entering this page, enter the state of parameter selection by using the "Confirm" button in the single-point operation panel, and select parameters by using the up or down button in the operation panel. When parameters are selected, the background color will be blue. After selecting the parameters, enter the setting interface by single point or long press the "Confirm" button.



On the device page, select Service Code and click the single point confirmation button to view it



On the device page, click Info to view the device

6.5 Suggestions on Setting User Parameters

The laser generally uses continuous mode, and the power slow rise/slow fall time is set to 500ms, which can ensure a good forming effect from the beginning to the end of the weld.

The larger the swing size of welding joint, the better the adaptability to the gap, but at the same time will weaken the energy distribution; Similarly, the higher the oscillation frequency, the lower the energy density. The recommended swing size range is 0.8~1.2mm and the frequency range is 100~200HZ.

It is recommended to weld 1mm thick plates at the focus position, and defocus -1mm when welding 2 and 3mm thick plates.

The protective gas is an inert gas. Argon or nitrogen is recommended. Argon is preferred. The pressure is about 0.2mpa. If the pressure is too high, the molten pool will be blown away and the splash will be increased. If the pressure is too small, the protection effect will not be achieved. Exhaust/close delay is set to 500ms, which can better protect the weld and welding lens.

The suitable welding speed is 1~6cm/s. Too low speed leads to too wide melting width and too large heat affected zone, which reduces the performance of welded joints. Fast passes are hard to control.

It is recommended that the thickness of the welded steel be 0 to 3mm, and the thickness of the aluminum and copper be 0 to 2mm. Welding more than this thickness of the material, the weld appearance and joint performance will deteriorate.

laser	power	0-1500 W
	Optical fiber core diameter	50 microns
The welding head	Focal length of collimator	50 mm
	The focal length of the focusing mirror	150 mm
The basic parameters	Swinging size	0-5 mm
	Oscillation frequency	0-300 HZ
	Welding Thickness Suggestion	Steel 3 mm or less; Aluminum, copper 2 mm or less
	Welding gap requirements	< 0.5 mm
	Welding speed suggestion	< 10 cm/s
	Oscillation parameter suggestion	0.8 ~ 1.2 mm, 100 ~ 200 hz
	Recommended gas pressure	Material 0.2 MPa

6.6 Welding Parameters of Common Materials

material	The thickness of the	The connection method	Laser power	Magnitude and frequency of oscillation	From the amount of coke	speed
Stainless steel	1mm	tailor-welded	60%	0.8 mm, 160 hz	0	4.5 cm/s
Stainless steel	1mm	Stir welding	80%	0.4 mm, 160 hz	- 1	4.5 cm/s
Stainless steel	1mm	vertical	70%	0.8 mm, 160 hz	- 1	4.5 cm/s
Stainless steel	2mm	tailor-welded	90%	0.8 mm, 140 hz	- 1	3.5 cm/s
Stainless steel	2mm	vertical	100%	0.8 mm, 160 hz	- 1	3cm/s
Stainless steel	3mm	tailor-welded	100%	0.8 mm, 120 hz	- 1	2.5 cm/s
Stainless steel	3mm	vertical	100%	0.8 mm, 100 hz	- 1	1.5 cm/s
Aluminum alloy	1mm	tailor-welded	80%	0.6 mm, 140 hz	0	4.5 cm/s
Aluminum alloy	1mm	vertical	90%	0.6 mm, 140 hz	0	4.5 cm/s
Aluminum	2mm	tailor-	100%	0.6 mm, 120 hz	- 1	1.5 cm/s

alloy		welded				
Aluminum alloy	2mm	vertical	100%	0.6 mm, 100 hz	- 1	1cm/s
brass	1mm	tailor-welded	90%	0.6 mm, 140 hz	0	4cm/s
brass	1mm	vertical	90%	0.6 mm, 140 hz	0	3.5 cm/s
brass	2mm	tailor-welded	100%	0.6 mm, 120 hz	- 1	1cm/s
brass	2mm	vertical	100%	0.6mm, 100HZ	-1	0.5cm/s

7. Troubleshooting/maintenance

If an alarm is generated, the Error indicator on the device panel is on red. There are 44 possible alerts. To determine which alarm bit is causing a particular error:

1. Check the laser power display on the front panel. The error code will appear on the LCD panel and will start with the letter "E" followed by a three digit number (for example, E003 for a three digit alarm). Many alarms can be eliminated in one of two ways.
2. Restart the welding system after power outage, the first thing it will do is try to automatically clear any alarms. As long as the condition that caused the error is resolved, the error should be cleaned up.
3. Connect through the computer serial port and use the HMI software provided by GW to clear the alarm.

Use a reboot: A small percentage of these alarms can only be cleared by restarting the unit. If the conditions that lead to it don't get

By the time it is resolved, the alarm may occur again. If this is the case, please contact GW after-sales personnel for help!

For the front panel error display, the severity of the warning increases as the number of errors increases. E027 is worse than E001. If multiple alarms occur, the upper alarm number is displayed on the front panel.

7.1 Error Information and Troubleshooting

Hand-held laser welding
system fault alarm code

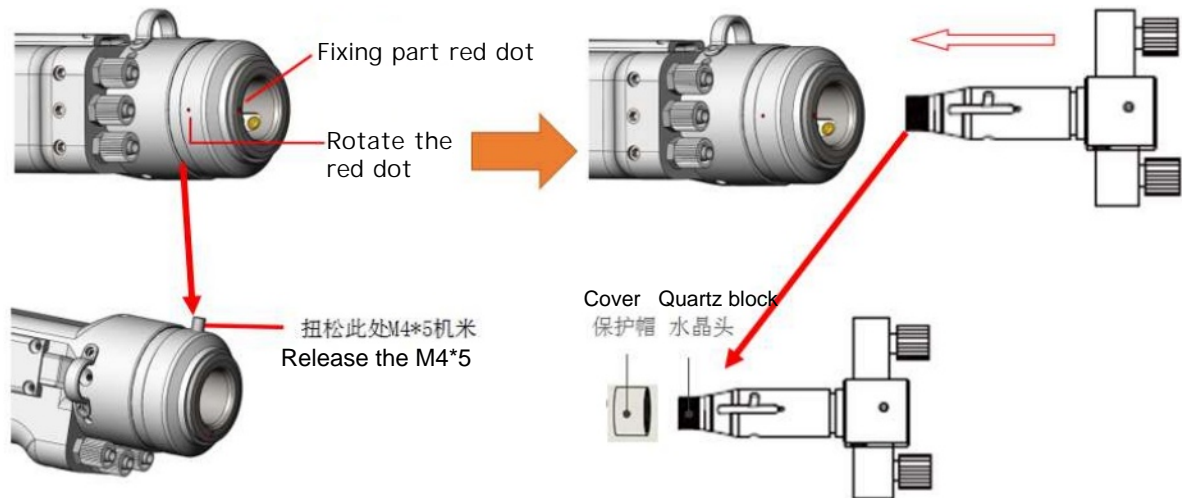
code	describe	The solution
S028	Laser locking	Contact GW after-sales personnel
E001	The communication of driver board 1 is faulty	Contact GW after-sales personnel
E002	The communication of driver board 2 is faulty	Contact GW after-sales personnel
E003	The communication of driver board 3 is faulty	Contact GW after-sales personnel
E004	The communication of driver board 4 is faulty	Contact GW after-sales personnel
E005	The AD communication is faulty	Contact GW after-sales personnel
E006	The diode module overheats	Contact GW after-sales personnel
E007	The driver module is overheated. Procedure	Contact GW after-sales personnel
E008	The water temperature of overheating	Contact GW after-sales personnel
E009	The optical fiber temperature exceeds the upper limit	Contact GW after-sales personnel
E010	The laser reflected energy exceeds the upper limit	After cleaning the collimator, if the alarm still cannot be eliminated, please contact GW after-sales personnel

E011	The laser output energy exceeds the lower limit	After cleaning the collimator, if the alarm still cannot be eliminated, please contact GW after-sales personnel
E012	Diode short circuit fault	Contact GW after-sales personnel
E013	Optical fiber disconnect	Contact GW after-sales personnel
E014	Super wet	Confirm the ambient humidity, if the alarm still cannot be eliminated, please contact GW after-sales personnel contact GW after-sales personnel
E016	scram	Press the emergency stop button, if the alarm still cannot be eliminated, contact GW after-sales personnel
E017	Air pressure fault	Contact GW after-sales personnel
E018	Narrow pulse protection	Contact GW after-sales personnel
E019	Overpressure on the drive board	Contact GW after-sales personnel
E020	Internal temperature failure	Contact GW after-sales personnel
E021	Drive the short circuit	Contact GW after-sales personnel
E022	Fault locking	Contact GW after-sales personnel
E023	Radiator not started	Contact GW after-sales personnel
C001	Communication failure of control system	Contact GW after-sales personnel
E901	Radiator overcurrent	Contact GW after-sales personnel
E902	Radiator out-of-step	Contact GW after-sales personnel
E904	Radiator underphase	Contact GW after-sales personnel
E905	The DC voltage is too low. Procedure	Contact GW after-sales personnel
E906	The DC voltage is too high.	Contact GW after-sales personnel
E907	The temperature sensor is too high	Contact GW after-sales personnel
E908	Abnormal temperature sensor	Contact GW after-sales personnel
E909	Abnormal communication	Contact GW after-sales personnel
E910	AC underphase or CT short line	Contact GW after-sales personnel
E911	The AC current is overcurrent	Contact GW after-sales personnel
E912	The AC input voltage is too low. Procedure	Contact GW after-sales personnel
E913	High voltage switch is abnormal.	Contact GW after-sales personnel
E914	IPM overtemperature protection	Contact GW after-sales personnel
E915	PFC module overtemperature protection	Contact GW after-sales personnel
E917	The diode temperature sensor is faulty	Contact GW after-sales personnel
E918	Ambient temperature fault	Confirm the ambient temperature and humidity. If the alarm still cannot be eliminated, please contact GW after-sales personnel
E919	The heat sink inlet temperature is faulty	Contact GW after-sales personnel
E920	The heat sink outlet temperature is faulty	Contact GW after-sales personnel
E921	Hypothermia at the two poles	Contact GW after-sales personnel

E922	Radiator failure	Contact GW after-sales personnel
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7.2 Maintain and replace welding joints

Maintenance personnel should turn off the device and remove the AC power connection before performing any kind of maintenance on the hand-held welding head. On the welding joint, rotate the silver nut counterclockwise to separate the cable (laser output cable) from the manual welder as shown below



8. The warranty

8.1 General Warranty

A. Guanghui (Shanghai) Laser Technology Co., Ltd. warrants that Guanghui (Shanghai) Laser Technology Co., Ltd. shall have no lien or encumbrance on the products after shipment.

B. Unless otherwise specified by Guanghui (Shanghai) Laser Technology Co., LTD., all products are subject to a 24-month warranty (from the date of shipment) against material defects and quality problems. According to paragraph 10 of Guanghui (Shanghai) Laser Technology Co., LTD.'s terms of sale, Guanghui (Shanghai) Laser Technology Co., Ltd. will choose 1) repair, 2) replacement and 3) refund for the confirmed defective products that are still under warranty. All repaired or replaced products are subject to the original warranty period of the original product, that is, only free of charge for the remaining warranty period of the original product. The buyer must make a written report for repair within 30 days upon discovery of quality problems. All repair requests must be made directly by the buyer, Guanghui (Shanghai) Laser Technology Co., Ltd. will not accept any third party repair requests.

C. The above repair report does not apply to product problems caused by: 1) Incorrect or inappropriate maintenance or calibration by personnel other than Guanghui (Shanghai) Laser Technology Co., LTD.; 2) Software, interface or power supply provided by the customer or a third party 3) unauthorized modification; Improper operation outside the limits of product parameters; 4) Abuse, negligence, accident, loss or damage in the process of transportation; or 5) unauthorized maintenance or repair.

D. The above warranty rules are unique. In addition, GUANGHUI (Shanghai) Laser Technology Co., Ltd. will not assume any form (whether express or default) of written or oral maintenance obligations and terms by regulations or laws. Guanghui (Shanghai) Laser Technology Co., Ltd. expressly waives its obligations and terms of maintenance implied by law, including, but not limited to, the implied warranties of merchantability and fitness for use.

E) The technical guidance and service provided by Guanghui (Shanghai) Laser Technology Co., Ltd. to customers will not affect the warranty provided by Guanghui (Shanghai) Laser Technology Co., LTD.

8.2 Service and Maintenance

There are no built-in parts for users to maintain. All repairs shall be carried out by personnel of Guanghui (Shanghai) Laser Technology Co., LTD. Therefore, any repair or replacement requirements in the scope of warranty must be notified to Guanghui or your regional service representative as soon as possible. Approved returned products must be placed in appropriate boxes. Upon receipt of the goods, any damage shall be reported in writing to the carrier in time.

IMPORTANT:

Please do not return products to Guanghui without a return commodity Authorization (RMA). If the warranty period of the product has expired or the product

is no longer within the scope of repair, the buyer will bear the cost of repair.

8.3 change

We reserve the right to make design and structural changes to the products, and we will not be responsible for any modifications to products of the same model that have already been sold.

MEMO: